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AUTHOR	Robinson, Paul
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ABSTRACT

The objective of the report was to emphasize the importance of classroom contingencies on academic achievement. A study is reported where an introductory psychology class of 253 subjects was divided into four groups. Using a Latin Square design an intraclass analysis of the effects of test frequency (weekly vs monthly) and contingency grading (test scores count or do not count toward the students' grade) is presented. Whether tests do or don't count toward grades was found to be a much more significant variable on academic achievement than test frequency. In the last half of the report the author presents a review of teaching methodology research showing no significant difference in academic achievement due to differing teaching procedures. Three different conclusions from this literature are presented to explain why educators are moving away from a more objective, highly structured instruction to more permissive approaches. A fourth conclusion of the literature is proposed to support the author's contention that education's move toward more permissive, non-structured classes is not the route to better student development. (Author)

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CONTINGENT SYSTEMS OF INSTRUCTION

CSI

by Paul Robinson

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The objective of the report was to emphasize the importance of classroom contingencies on academic achievement. A study is reported where an introductory psychology class of 253 subjects was divided into four groups. Using a latin square design an intraclass analysis of the effects of test frequency (weekly vs. monthly) and contingency grading (tests scores count or do not count toward the students' grade) is presented. Whether tests do or don't count toward grades was found to be a much more significant variable on academic achievement than test frequency. In the last half of the report the author presents a review of teaching methodology research showing no significant difference in academic achievement due to differing teaching procedures. Three different conclusions from this literature are presented to explain why educators are moving away from a more objective, highly structured instruction to more permissive approaches. A fourth conclusion of the literature is proposed to support the author's contention that educations move towards more permissive, non-structured classes is not the route to better student development.

In his article entitled "What Behavioral Engineering Is," Homme states, "The phrase 'behavioral engineering' has been around a long time, and all of us understand it. The only trouble is - we haven't told anyone, including ourselves, what it means . . . the topic of what behavioral engineering is could stand some elaboration." I believe somewhat the same thing can be said about PSI (Personalized System of Instruction). Different instructional procedures have sprung up at various universities bearing the PSI label. Some allow students to proceed through the course at their own speed, some don't. Some use proctors and give oral examinations, some use written exams, and some use both. Some use general psychology texts, while others develop specific programmed materials. In some the students are not required to attend lectures, in some the students must attend discussion groups, while others employ lectures as reinforcers to be given only to those students who master the course material. This has resulted in many requests of Fred Keller and Gil Sherman to elaborate on what PSI is. At the last RMPA convention Dr. Sherman noted that he and Dr. Keller were presently engaged in writing a book which would define PSI more clearly and possibly give some direction with respect to its use and potential.

This presentation deals with an attribute, however, which I believe most would include in a definition of PSI. It involves making the instructor's evaluation of the student (usually their grade) contingent upon the student's performance by means of examinations. In the past, grading students according to their performance has been considered the backbone of our educational system. After all, isn't it the height of objectivity and hasn't objectivity been a mainstay in our society's advancement? In many areas (medical, industrial, biological, and statistical research) objectivity has been welcomed with open arms; and repaid its host with a wealth of technological advancements.

Unfortunately, however, the marriage between educators and objectivity has not been a happy one. In fact, a large portion of the educators have divorced themselves from objectivity and started courting a permissive educational approach, such as student self-development and "non-contingent" classroom environments. For example, Wolfle(1968) proposed students should decide whether they be graded or not. He suggested a student's accomplishments in college were determined by his own ability, knowledge, and motivation, and at best only slightly by the characteristics of his teacher and his college.

At Brigham Young University a committee formed to analyze course evaluations became embroiled in the controversy of whether classroom grading was a help or a hindrance to academic achievement. It was decided some light could be shed on this issue by carrying out a study to evaluate the effects of grading on testing. Seeing frequency of examinations was also questioned, a study was carried out to note the effects of exam frequency and whether they counted toward the student's grade.

Method

Subjects

Two hundred ninety-nine students enrolled in an Introductory Psychology course at Brigham Young University during the spring semester of 1971 served as subjects (Ss). Any S who did not finish the course, or failed to take one of the four comparison tests, was dropped from the study. Twenty-two Ss dropped the course while 24 Ss failed to take at least one of the four comparison tests. This left 253 Ss on which the comparisons were made.

Procedure

On the first day of class the students were divided into four groups according to the first letter of their last name (Group I = A-F, Group II = G-L, Group III = M-R, Group IV = S-Z). A course outline was distributed to all Ss stating the procedure to be followed during the term. Class was held for one hour every Monday, Wednesday, and Friday with attendance mandatory. Fifty minute lectures were given on Mondays and Wednesdays with written examinations administered on Fridays.

Two main aspects of testing were manipulated in this study: frequency of examinations (weekly vs. monthly) and the effect of the exams on the Ss' grade (count toward grade vs. not counted toward grade). There were a total, then, of four different testing conditions: (a) weekly exams given which counted towards the S's grade, (b) weekly exams given which had no effect on the S's grade, (c) monthly exams given which counted towards the grade, and (d) monthly exams given which did not count towards the grade. Using a latin square design each of the four groups experienced all four testing conditions during the term. Table 1 shows how this was done.

The term was divided into four time periods, the first being three weeks long and each of the remaining three periods four weeks long.

Table 1

Testing schedule for all four groups of Ss. Each box indicates whether the particular group took an exam, whether it counted or not, and how many points it was worth.

WEEK	GROUP I	GROUP II	GROUP III	GROUP IV
1	30 point count	30 point NO count	NO TEST	NO TEST
2	30 point count	30 point NO count	NO TEST	NO TEST
3	80 point count	80 point NO count	80 point count	80 point NO ct.
4	NO TEST	20 point count	20 point NO ct.	NO TEST
5	NO TEST	20 point count	20 point NO ct.	NO TEST
6	NO TEST	20 point count	20 point NO ct.	NO TEST
7	80 point NO ct.	80 point count	80 point NO ct.	80 point count
8	NO TEST	NO TEST	20 point count	20 point NO ct.
9	NO TEST	NO TEST	20 point count	20 point NO ct.
10	NO TEST	NO TEST	20 point count	20 point NO ct.
11	80 point count	80 point NO count	80 point count	80 point NO ct.
12	20 point NO ct.	NO TEST	NO TEST	20 point count
13	20 point NO ct.	NO TEST	NO TEST	20 point count
14	20 point NO ct.	NO TEST	NO TEST	20 point count
15	80 point NO ct.	80 point count	80 point NO ct.	80 point count

During the first time period Group I Ss were given weekly 10 question multiple choice exams which counted toward their grade; Group II was given the same weekly exams though they did not count toward their grade; Groups III and IV were excused on Fridays and took no weekly tests. At the end of the first time period, a fourty-Question multiple choice

exam was given to all four groups. For Groups I and III the forty question exam counted towards their grade, but for Groups II and IV it did not. During the second time period (weeks 4 through 7) Groups I and IV took no weekly exams, Groups II and III took weekly exams though they did not count for Group III. All four groups took a forty question (80 point) exam at the end of Week 7 with it counting toward the grade for Groups II and IV, not for Groups I and III.

As can be seen in Table 1, the testing conditions for each group changed during each time period in such a way that all four groups had experienced all four testing conditions. All questions used in the weekly and monthly exams were taken from the testing file supplied by the publishers of the course text, Introductory Psychology, Fifth Edition by Ernest Hilgard, Richard Atkinson and Rita Atkinson. All four monthly exams were noncumulative. They tested only on the material covered during the time period the particular exam followed.

Results

As can be seen in Figure 1, whether an exam counted toward the student's grade or not significantly ($P < .01$) influenced the student's score. The mean comparison between count (weekly plus monthly) and no count (weekly plus monthly) was 50.3 and 41.6 respectively. With respect to a cumulative grade distribution for all Ss the count Ss averaged a little better than a "B" (3.2) while the no count Ss' mean was a little worse than a "C-" (1.6).

Exam frequency did not show up as a significant variable with the mean for the weekly (count plus no count) was 46.5 while the mean for the monthly (count plus no count) was 45.5.

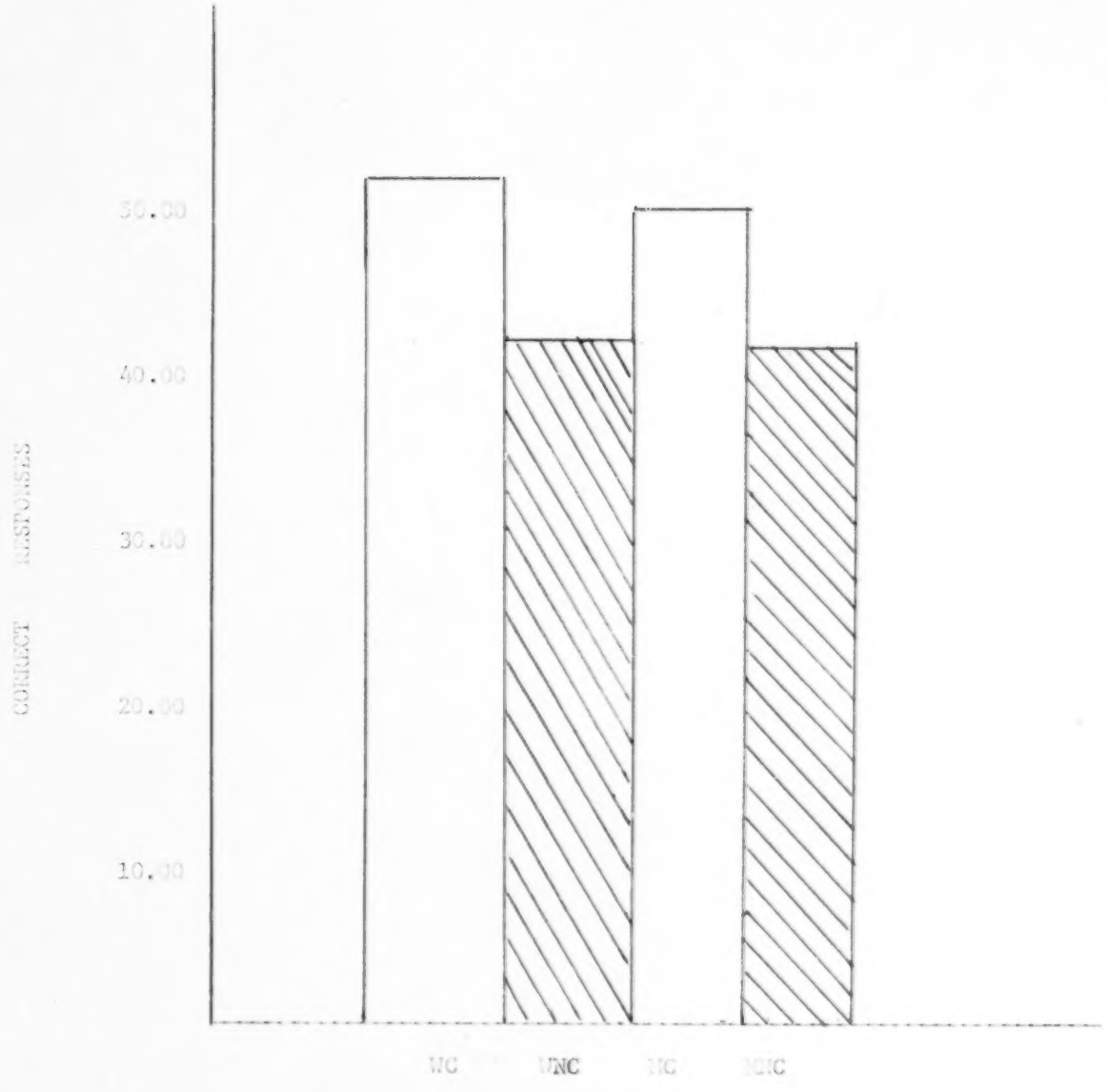

Fig. 1. The mean number of correct responses for all four groups. (WC - weekly exams, count; WNC - weekly exams, no count; NC - monthly exams, count; NNC - monthly exams, no count)

Discussion

With the results of this study and those of PSI demonstrating the importance of making grades contingent on behavior it may be difficult to understand why such a large portion of the educators have discarded an objective approach. It is not so difficult to understand, however, when you review the literature on teaching methodologies and note the conclusion which has been consistently reported by various reviewers for the last forty years.

In 1932 Longstaff reviewed the literature on teaching methodology up to that time and stated: "The experimental evidence submitted to the present time tends to support the general conclusion that there is little difference in achievement in large and small classes and, also, that it makes little difference as to what method of presentation of materials of the course is used." Wolfe summarized research up to 1942 simply by repeating Longstaff's statement. In a 1954 review, McKeachie made the following statement: "One would expect that the controversy between our education's authoritarians and permissivists would long ago have been resolved by the cold logic of experimental studies. Unfortunately, this just hasn't happened." In 1968 Dubins and Taveggia reviewed the literature as did McKeachie again in 1969. Their evaluations were similar to their predecessors; no teaching method (lecture, discussion, self instruction, or otherwise) demonstrated superiority in facilitating academic achievement. Figure 2 gives a summary of a substantial portion of the studies done on teaching methodologies since the 1920's.

Figure 2. Comparisons of various teaching methods. (N-number of studies)

Lecture versus Discussion	N	%
Studies Favoring Lecturing	45	51.1
Studies Favoring Discussion	43	48.9
Studies Showing No Difference	0	0.0
Total	88	100.0

Lecturing versus Lecturing plus Discussion	N	%
Studies Favoring Lecture	3	37.5
Studies Favoring Lecture-Discussion	4	50.0
Studies Showing No Difference	1	12.5
Total	8	100.0

Supervised Independent Study vs. Lecture Type	N	%
Studies Favoring Independent Study	24	48.0
Studies Favoring Lecture Type Instruction	26	52.0
Studies Showing no Differences	0	0.0
Total	50	100.0

Supervised Independent Study vs. Discussion	N	%
Studies Favoring Independent Study	5	71.4
Studies Favoring Discussion	2	28.6
Studies Showing No Difference	0	00.0
Total	7	100.0

Supervised Independent Study vs. Lecture - Discussion	N	%
Favoring Supervised Independent Study	11	47.8
Favoring Lecture-Discussion	12	52.2
No Difference	0	0.0
Total	23	100.0

Unsupervised Independent Study vs. Lecture-Discussion	N	%
Favors Unsupervised Independent Study	15	60.0
Favors Lecture-Discussion	10	40.0
No Difference	0	0.0
Total	25	100.0

Supervised Independent Study vs. Unsupervised Study	N	%
Favors Unsupervised Study	3	25.0
Favors Supervised Study	9	75.0
No Difference	0	0.0
Total	12	100.0

Of all the conclusions made from the literature three received a large following. For many the literature simply reinforced their contention that education had long been laboring under the fallacious assumption that an objective scientific methodology could be applied to the analysis of comparative teaching methods. To this group the assumption that classroom variables could be controlled and manipulated to such a degree that the effect of different teaching procedures would manifest themselves and be differentially measured was completely erroneous. They believe the teaching-learning process is so complex and sacrosanct that it is above such a cold mechanical analysis. To them the apparent failure of the scientific method in education plus its success in other areas naturally lead to the conclusion that it is a useful methodology; but restricted to areas outside the teaching-learning process. Highet (1965) expressed it well for this point of view when he said "Scientific teaching, even of scientific subjects, will be inadequate as long as both teachers and pupils are human beings. Teaching is not like inducing a chemical reaction: it is much more like painting a picture or making a piece of music, . . . You must throw your heart into it, you must realize it cannot all be done by formulas, or you will spoil your work, and your pupils, and yourself."

Another conclusion which many chose dealt with the complexity of the learning process. They felt the scientific approach to learning was appropriate, but that the complex interaction of relevant variables made the analysis too difficult. McKeachie (1969) emphasized this point of view when he stated: "My own rationalization is that teaching and learning is an enormously complex business in which so many variables are involved that the interaction effects, like method effects, pop up only a little way above the noise generated by other variables."

Dubin and Taveggia's conclusion on why no differences showed up between teaching procedures also has a strong following. They felt teaching procedures were having differential effects, but that course examinations were too insensitive to teaching procedures for discriminating student's academic achievement. The positive results of PSI studies in the past few years indicate that these three conclusions are incorrect. PSI results show education does land itself to objective analysis; the teaching-learning relationship is not too complex to be analyzed; and examinations are sensitive enough to discriminate between teaching procedures. Are we to conclude, then, that the PSI results are correct, but the previous research is wrong?

No, there is a fourth conclusion which most people have overlooked which completely agrees with the assumption that both PSI results and previous comparative teaching results are correct. I propose the reason various teaching procedures have not produced differential effects in the students is because relevant study behavior of the student were not differentially affected. Let's take the comparison of lecture versus discussion as an example. Using a typical lecture method, the instructor stands in front of the class and lectures on a certain amount of material. An exam is given every four or five weeks. Using a discussion technique the instructor now sits down and leads them over the material. Every four or five weeks an exam is given. The difference between the two methods, then, is mainly the behavior of the instructor, not the students. Granted, the discussion method allows for increased participation. However, there is usually a small percentage of the group that does most of the talking. This becomes more apparent the larger the class. Also, there are no contingencies

applied so the verbal responses in the discussions will differentially influence student studying any more than lectures. Most of the students are simply waiting for class to end as is the case for the lecture procedure. The situation, then, is that the instructor's behavior has changed, but not the students' in any dimension which significantly influences studying the course material.

With PSI on the other hand, contingencies for students' behavior is the central theme. For example, he must take exams (oral or written) over the course material; if he doesn't obtain a certain level of mastery, he must go back over the material until he does; he is graded on how well he can verbalize the material. In this way, the course is centered on what the student does, not what the instructor does.

The results of PSI and the traditional comparative studies lead me to the conclusion that the secret of an effective teaching procedure is that it should be a Contingent System of Instruction (CSI).* Academic achievement can be controlled by introducing contingencies which require the student to interact with course material. For example, the effectiveness of the previously cited discussion procedure could be increased by (a) requiring the students to hand in an abstract on the material to be discussed, and (b) grading the students on the comments they make in the discussion about the material. With contingencies such as these added, I predict the discussion procedure would then show superiority over the typical lecture.

Removing classroom behavioral contingencies will not be a productive approach for the educational system in general. Behavior in our society is too much a function environmental influence and there are too many

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*I perceive CSI as a system with many alternative subsystems, such as PSI. One such alternative to PSI will be presented at the Friday's symposium on PSI.

alternative reinforcers for us to expect a student to excel in education when requirements are withdrawn. The battle between non-graded study behavior and miniskirts was won a long time ago. Man is not most productive when behavioral contingencies are removed. Those who do excel in non-structured situations do so because they have internalized the reinforcing relationships which control academic achievement. Most of us, however, are too dependent upon the external environment for stimulation to achieve.

The answer for education in general, then, is the development and application of contingent systems of instruction, such as PSI, rather than self-directed learning. As the results indicate, grades are too strong a reinforcer to realistically remove them from education. It is theoretically possible, I believe, for an effective educational program to exist which is built on reinforcers other than grades, but such a dramatic change would be required in all aspects of our society that for all intents and purposes it is not very feasible.

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